



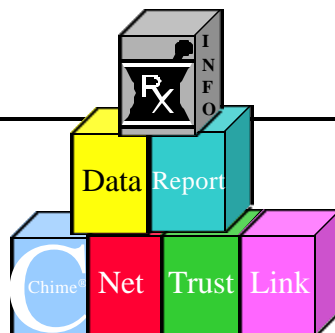
CHIME

Connecticut's Model for National Healthcare Informatics Infrastructure: Network, Web EDI, PKI, and Data Mining

John Lynch
Vice President

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p.1



“CHIME” was established in 1980 by the Connecticut Hospital Association’s Research Foundation (CHREF) as program for coordinating the collection and distribution of Health Care data. In 1996, CHIME was formally incorporated as a for-profit affiliate of the Connecticut Hospital Association. The principal products of CHIME include CHIME-Data, CHIME-Report, CHIME-NET, CHIME-Link, CHIME-Trust, and RxInfo.

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p.2



NIST ATP Projects



- Healthcare Information Infrastructure Technology (HIIT)

ATP 94-04 (70NANB5H1011) 3/95-2/98

– CHREF JV partner for Healthcare testbed and EDI



- Healthcare Information Technology Enabling Community Care (HITECC)

ATP 95-10 (70NANB5H1195) 11/95-10/98

– CHREF JV Partner for MPI, security testbed



- RxInfo: Data Mining Tools for Assessing the Impact of Pharmaceutical Therapies on Population Based Healthcare Outcomes

ATP 97-03 (70NANB7H3035) 3/98-2/2001

– CHIME Lead Organization

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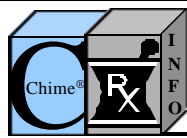


RxInfo Goals

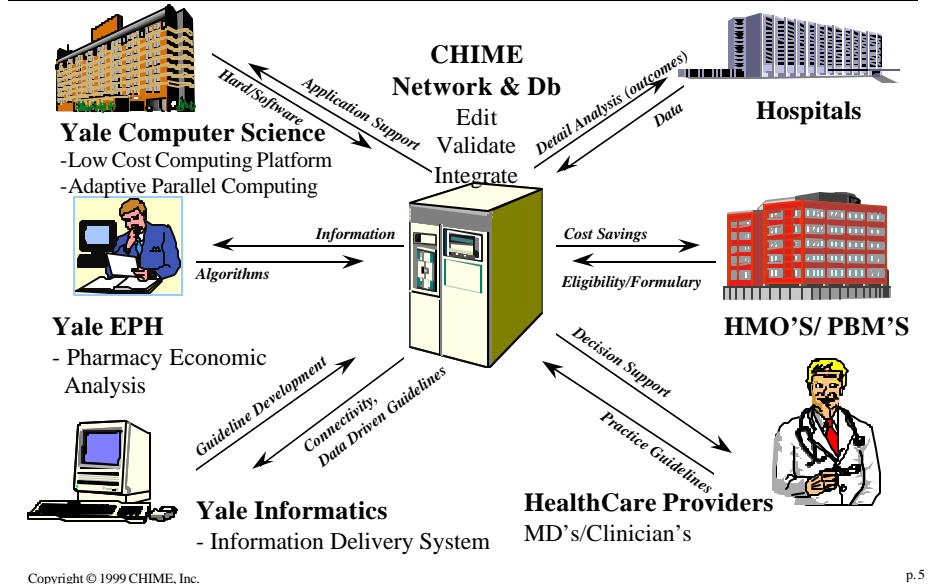
- To develop tools and reports that would enable healthcare practitioners and researchers to evaluate drug therapies based on past clinical experiences at hospitals and healthcare settings.
- To pursue technology associated with outcomes-based data mining of pharmacy data.
- To pursue new technologies for the delivery and utilization of pharmaceutical information.

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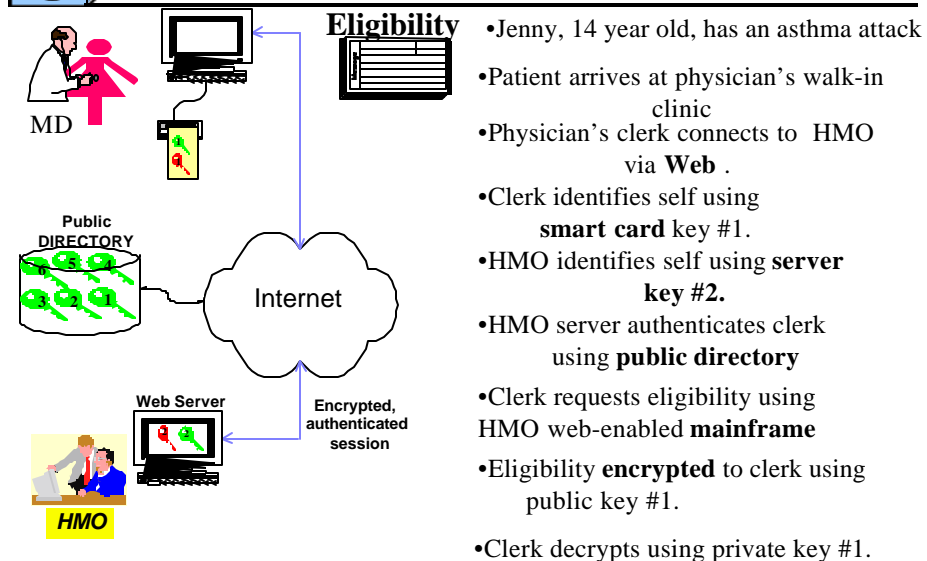
p.4



RxInfo Team

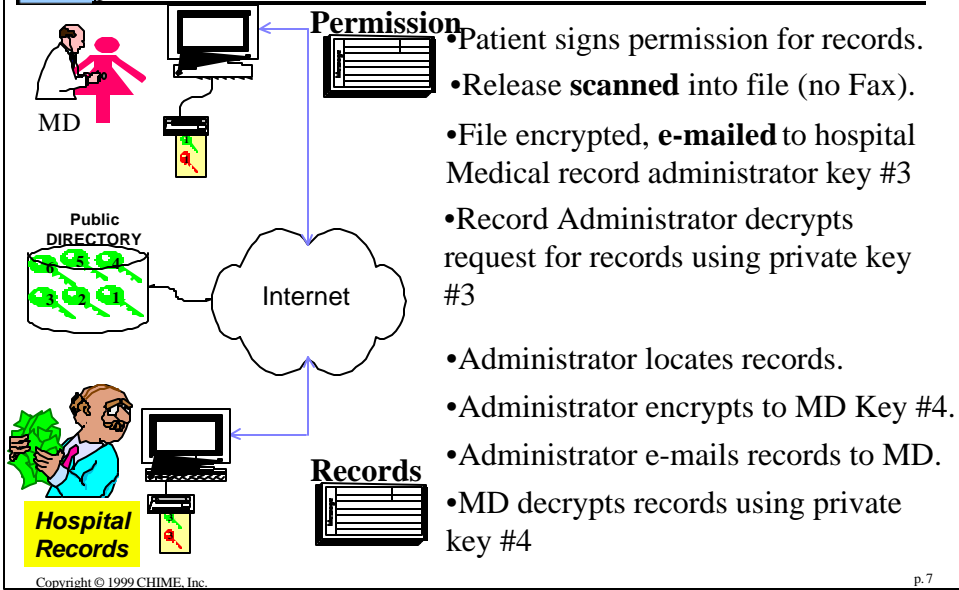


Healthcare Scenario #1

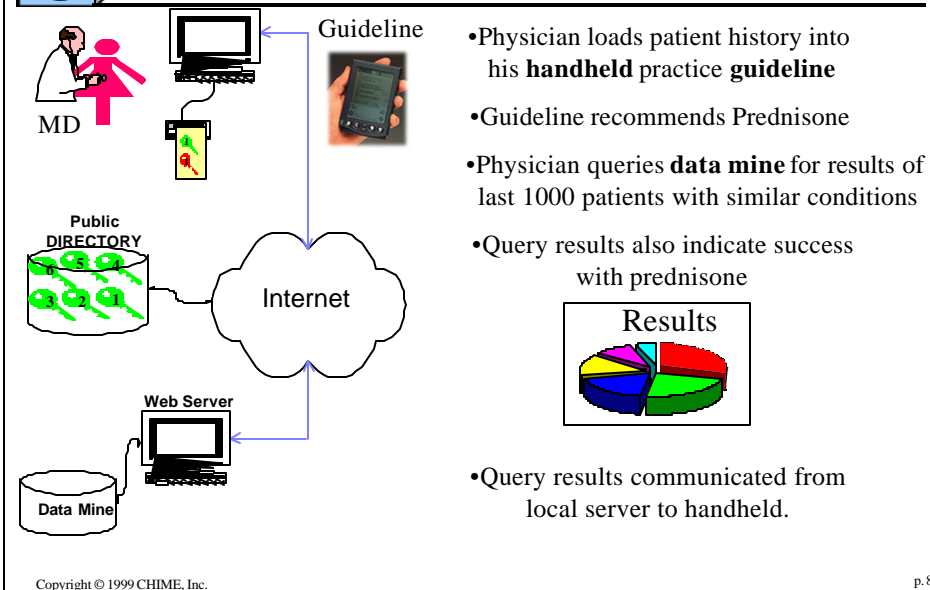


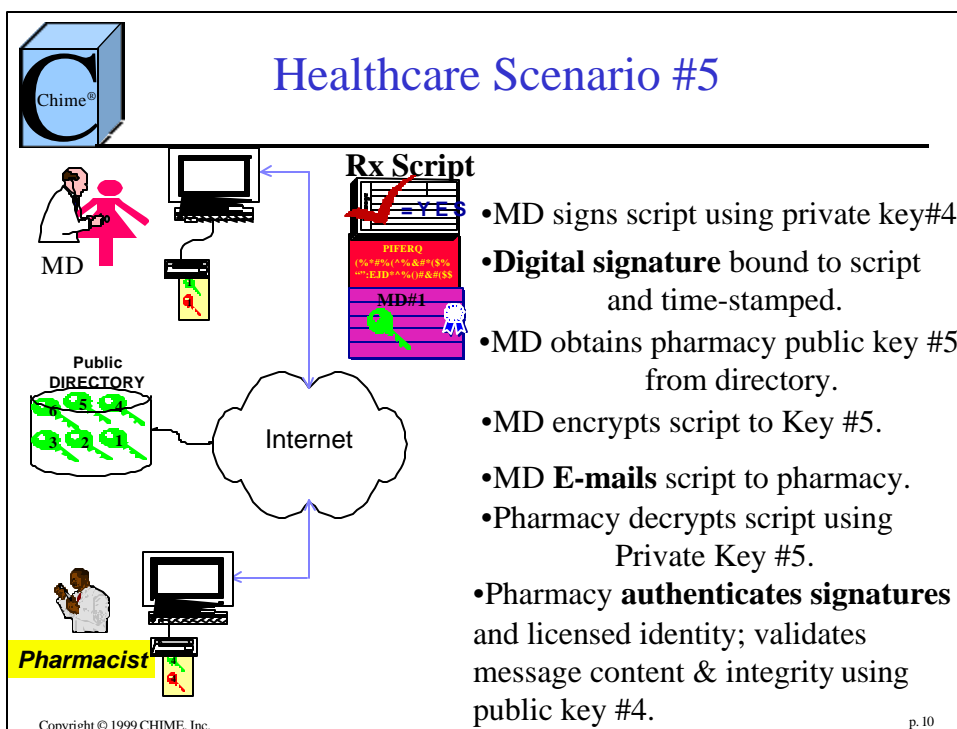
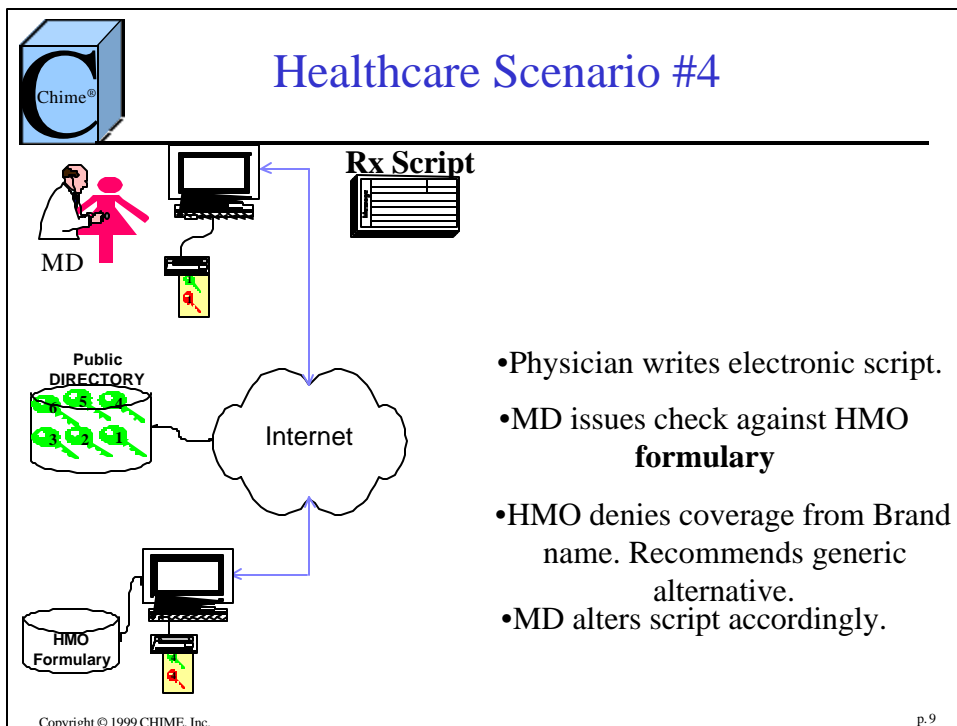


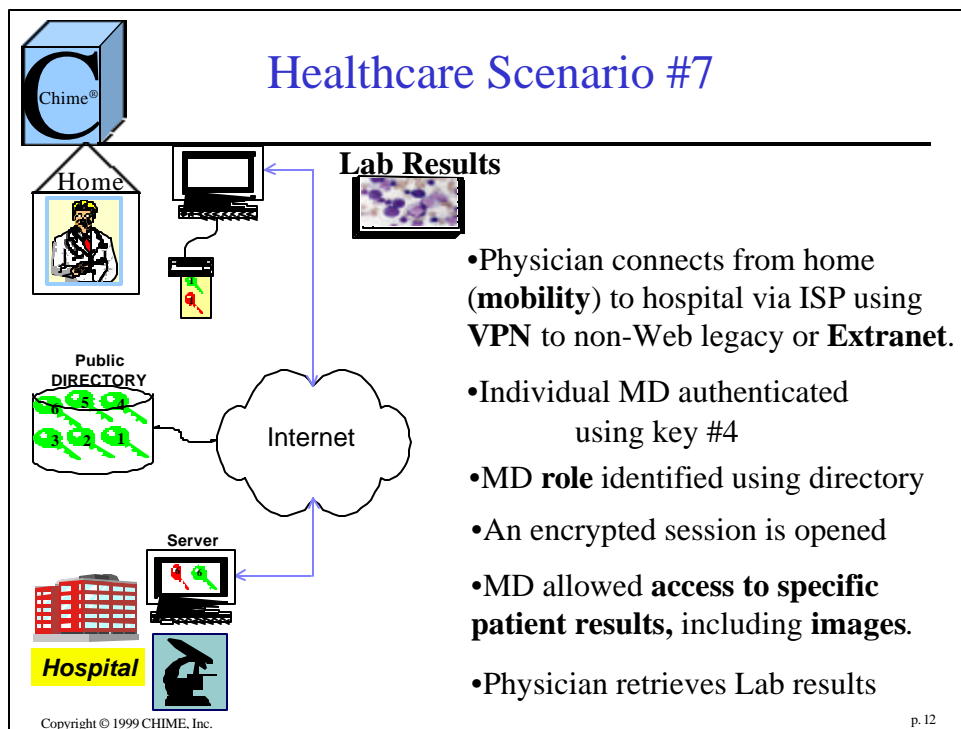
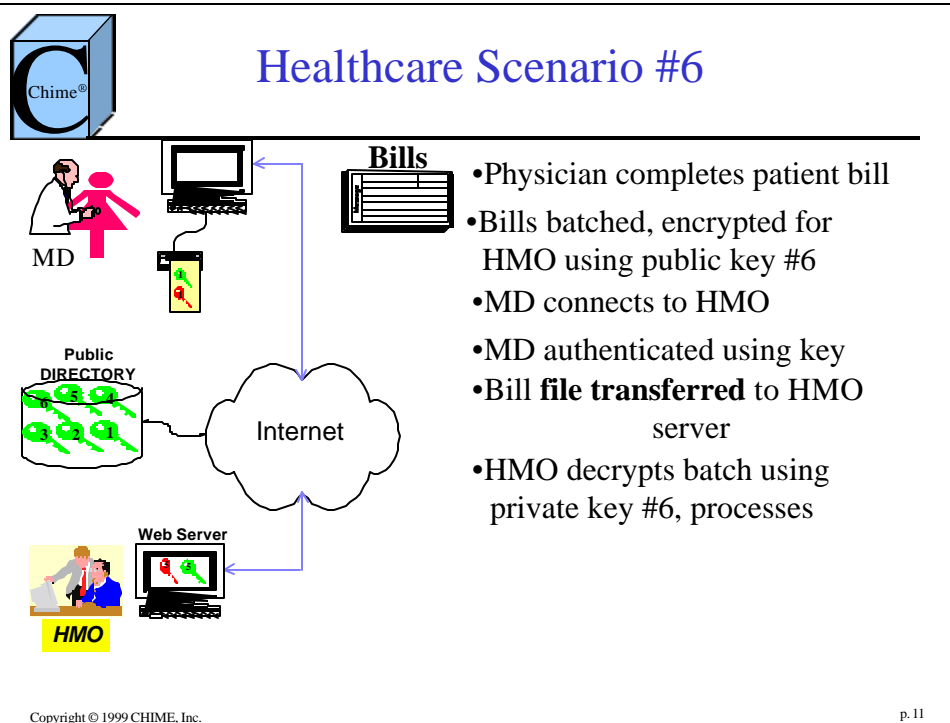
Healthcare Scenario #2

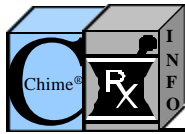


Healthcare Scenario #3









Technical Challenges Infrastructure

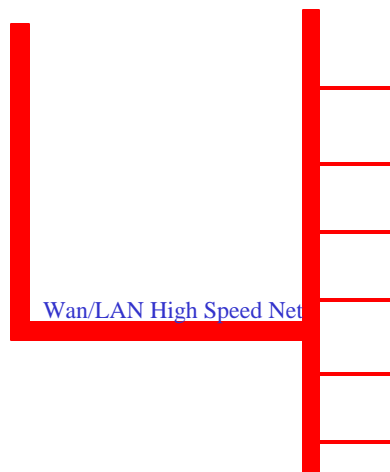
- Healthcare ATP Testbed
- Controlled Bandwidth
- Connectivity to Disparate, Distributed Systems
- Open System, Standards

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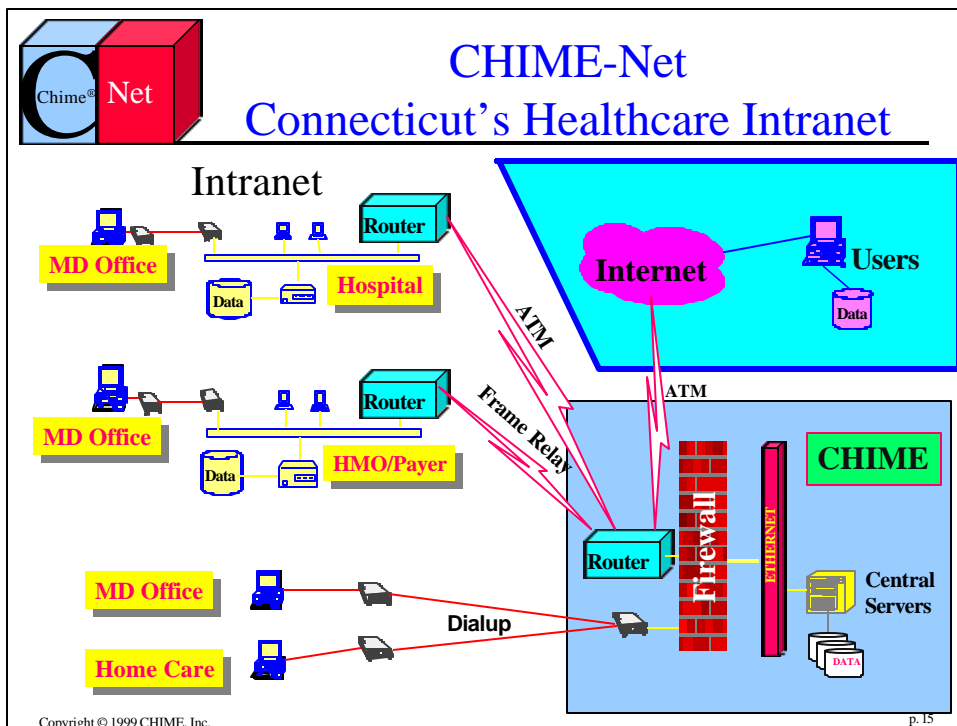


CHIME Solution: Network Infrastructure



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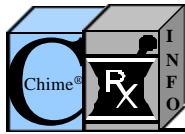
p. 14



CHIME-Net ISP Services

- Provide high bandwidth connectivity to the Internet
- Provide point to point scalable Dial-up, Frame Relay, and ATM access for participants.
- Connections: NDC, ENVOY, Blue Cross, Insight
- E-Mail Accounts
- DNS Hosting
- Web Site Hosting
- Network Monitoring/ Performance Reporting
- Network Support
- Security: PKI: CA, RA, Encryption, Directory

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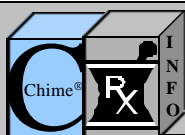


Technical Challenges Large Scalable Data Sets

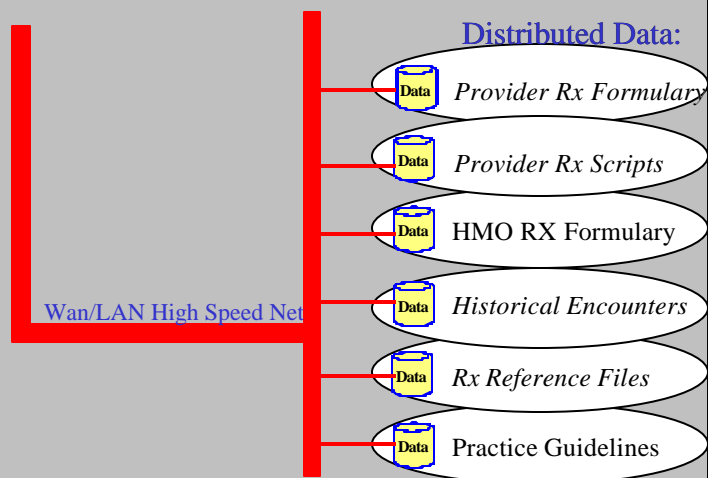
- Disparate, Distributed Data sets
- Population studies require comprehensive sets
- There is NO standard “prescription” format
- Each hospital assigns definition and meaning differently.
- Different meaning for same elements between hospitals using similar computer systems.

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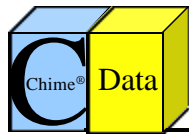


CHIME Solution: Large Scaleable Data Sets

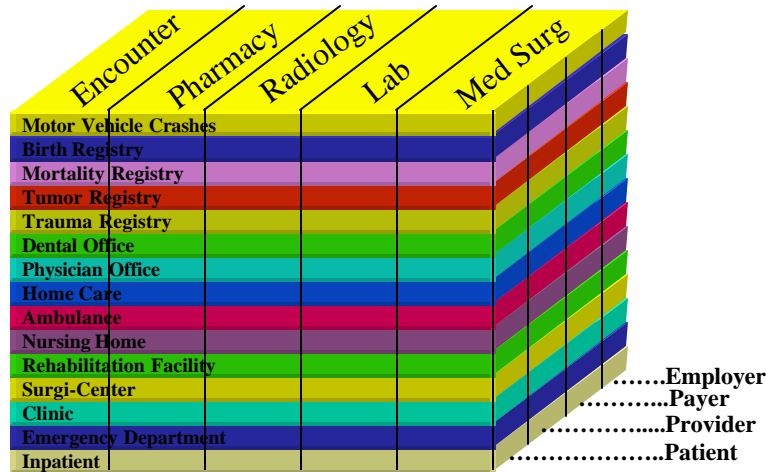


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CHIME-Data



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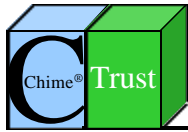


Challenges: Security

- Technical Challenges -
 - Controlled access based on role, identity and privileges
 - Integration of multiple complex technologies and products including NetScape and Internet Explorer
 - Linking Security with Health Care Applications
 - Moving multiple vendors to healthcare standards
- Operational Challenges -
 - Preserve integrity and reliability of health Care's credentialing and accreditation process
 - Accommodate individuals affiliated with more than one institution
 - Ensure uniform trust across all organizations
 - Ensure interoperability across all organizations
 - Jurisdictional variations
 - Transcend industry boundaries (e.g. Providers, Insurers, Employers, Patients)

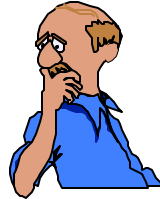
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HIPAA Information Access Requirements

- **Entity Authentication**
 - Unique User Identification (token/biometric)
- **Authorization Controls**
 - Role/Context Based confidentiality
- **Data Authentication**
 - Digital Signature
 - Non-Repudiation
 - Data Integrity
- **Audit Controls**
 - Privacy/logging (Track ALL individuals accessing records)
- **Communications Controls** (encryption)



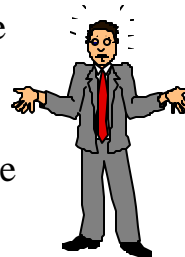
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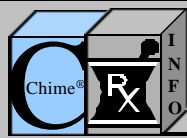
The User's Unanswered Questions

- How can we be certain about the identity of the person with whom we are communicating?
- Who can see the information?
- How can we be certain that transactions are conducted with privacy and have not been tampered with?
- Who really signed which components of the document?
- When was it completed?
- Will one party deny, at a later date, that the transaction took place?

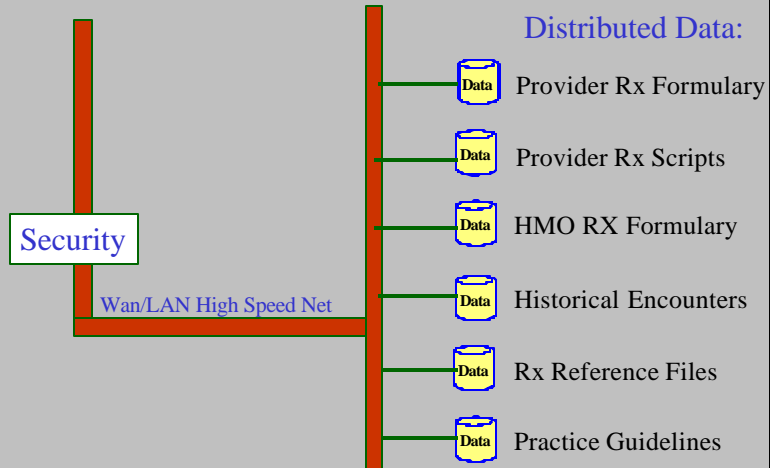


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p. 22

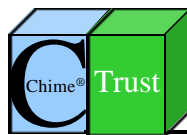


CHIME Solution: Security Infrastructure/Standards

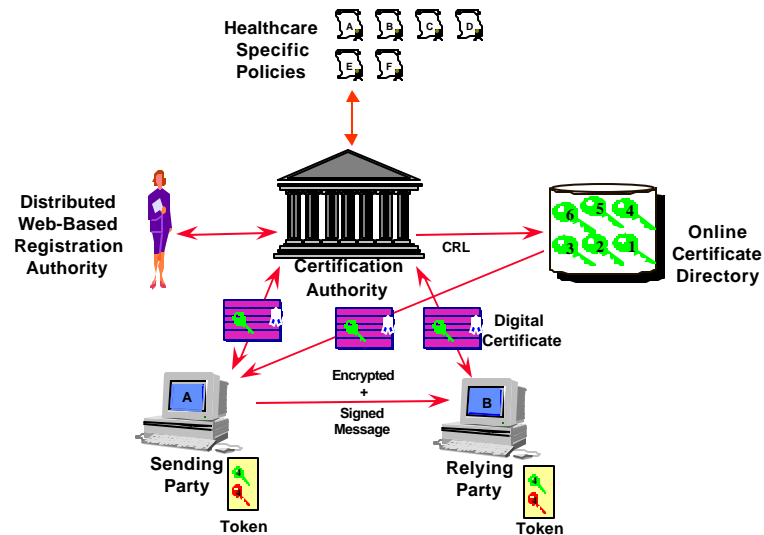


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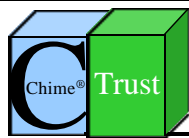


CHIME-Trust Solution: PKI Components

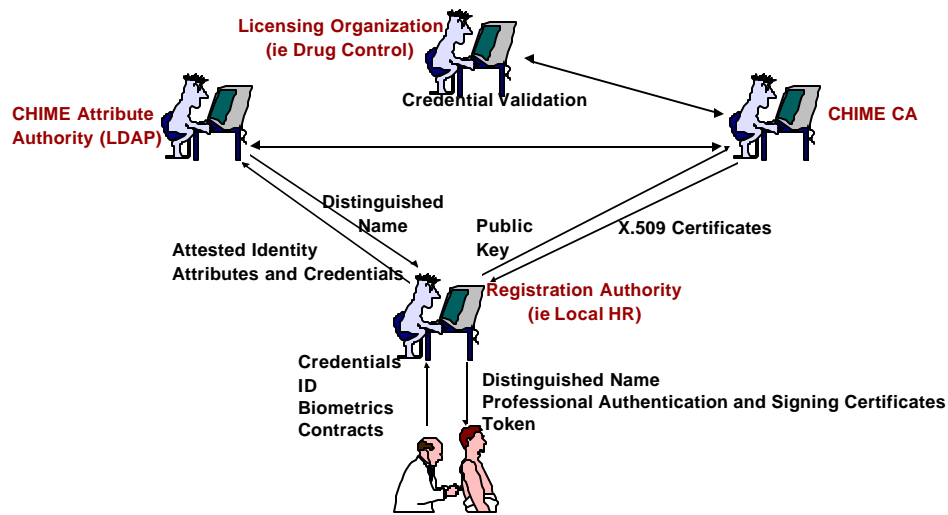


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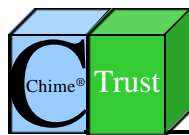


Unique CHIME RA: Healthcare Professional Enrollment



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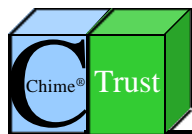
CHIME Digital Certificate Types

- Patient
- Employee
- Licensed Health Care Professional
- Board Certified Professional
- Organizational (payer, employer)
- Licensed Healthcare facility

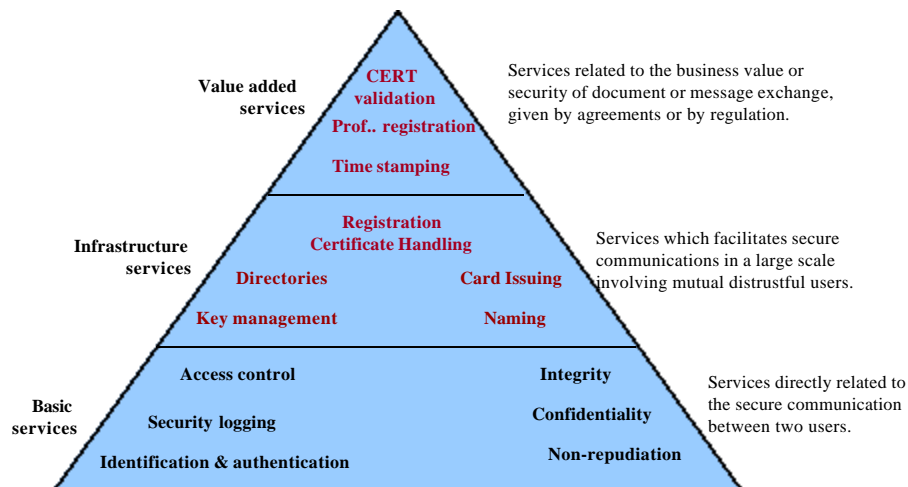


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CHIME-Trust Solution: Security Services

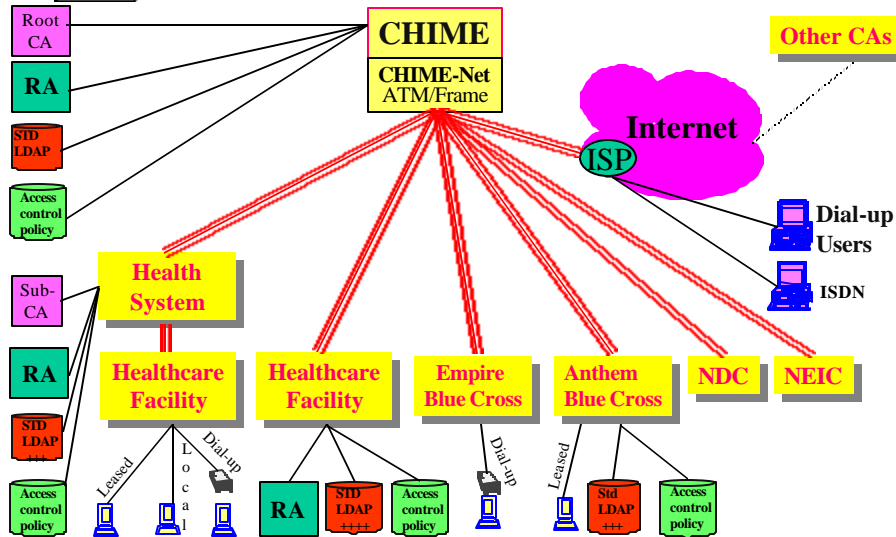


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p. 27

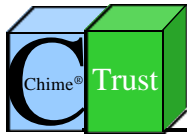


CHIME-Trust Security Model



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Chime-Trust

Demonstrated success

- Certificate registration & issuance process
- Inter-organization certificate interoperability
- Directory based access privilege management
- Directory based certificate validation
- Use of certificates for application access control
 - web browser-server protecting web-based clinical services
 - e-mail
 - VPN e.g. access to non-web client-server HIS.
 - Legacy applications (e.g. BCBS Medicare Claims processing)
 - EDI
 - Native HIS

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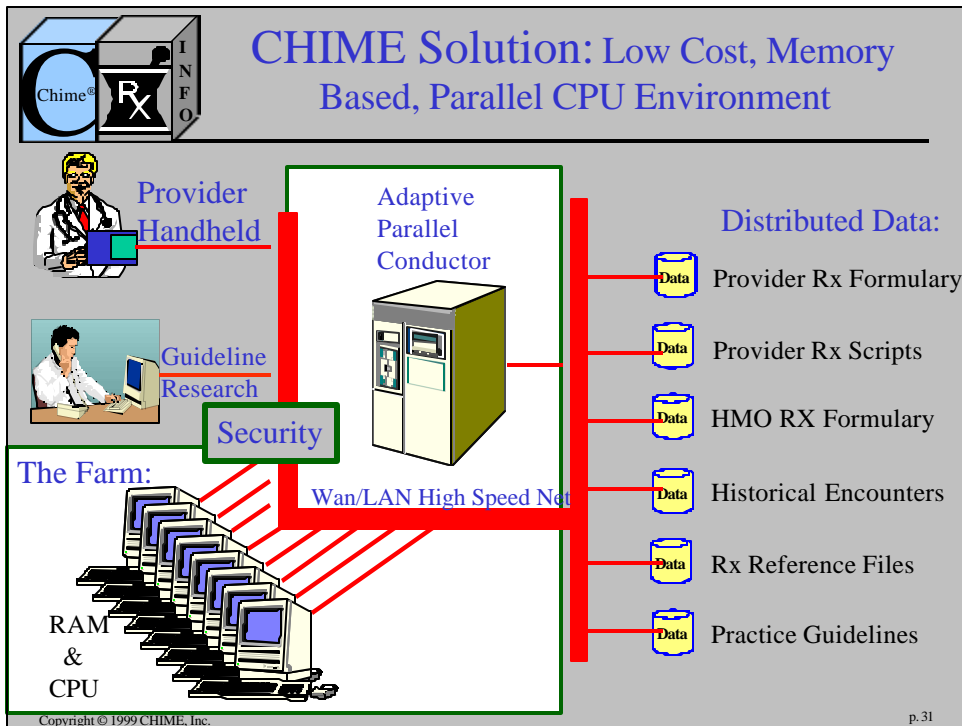
Technical Challenges

Data Mining

- Load balancing
- Query optimization
- Complex data mining
- Identify Suitable Engine with Source Code
- Bridging the 'Gap' - Extracting the Algorithms
- Parsing of Free text fields
- Ontology for Report Drill Down
- Linking Disparate data sets for longitudinal view
- Multiple EDI transmission formats
- Availability of data

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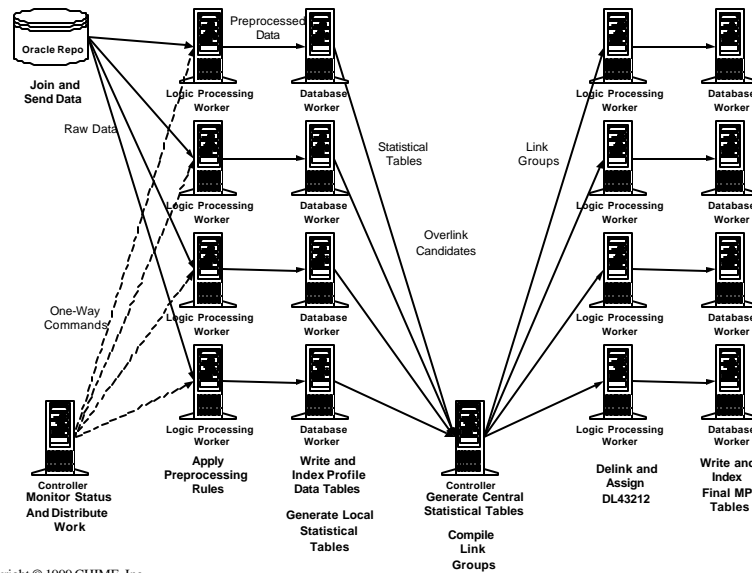
Memory Based Parallel CPU Environment

- Complexity of linking and data mining require high performance
- Need capacity for future growth
- Parallel Intel-based systems
 - Emphasis on RAM memory capacity
 - Adequate disk and CPU capacity

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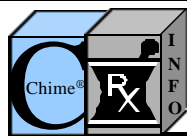


Borg Data Flow



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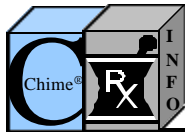


Development of a simple main memory database engine.

- “Simple” of necessity and by design.
- Basic optimizations.
 - Dynamic memory pooling.
 - Non-malloc’ed storage for expression evaluation.
 - Expression “fixing”—a form of common subexpression elimination.

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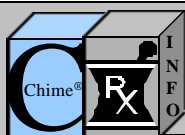


Technical Challenges

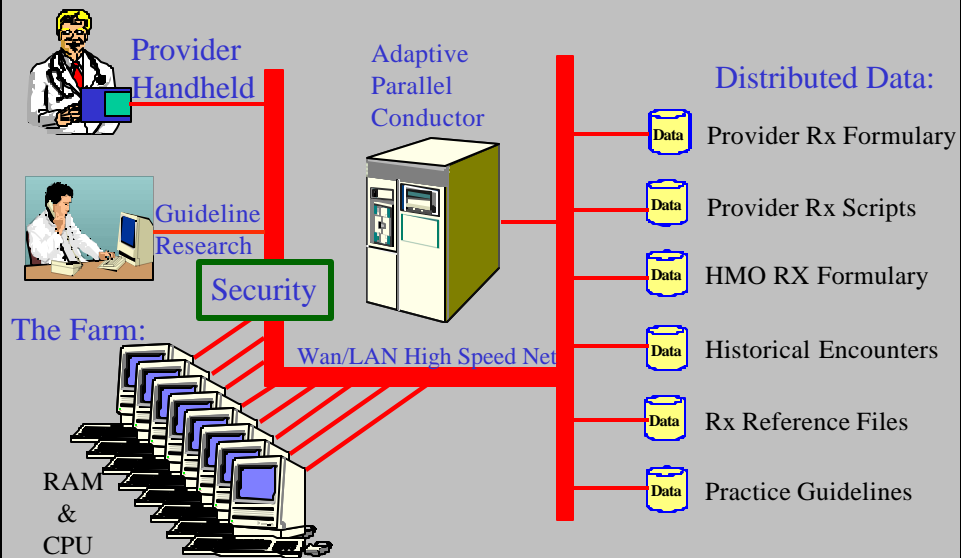
- Disparate Data Sources
 - Data from different hospitals are in different format.
 - Merging into a common format.
- Denormalized Data
 - Need to re-normalize the data in order to construct a multi-dimensional model.
- Diverse Population of “User” Needs
 - More views/facts tables
 - Optimization problem and Data explosion

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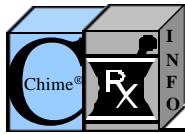


CHIME Solution: Pharmaceutical Data Mining/ Algorithms



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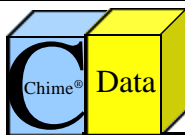


Linking Challenges

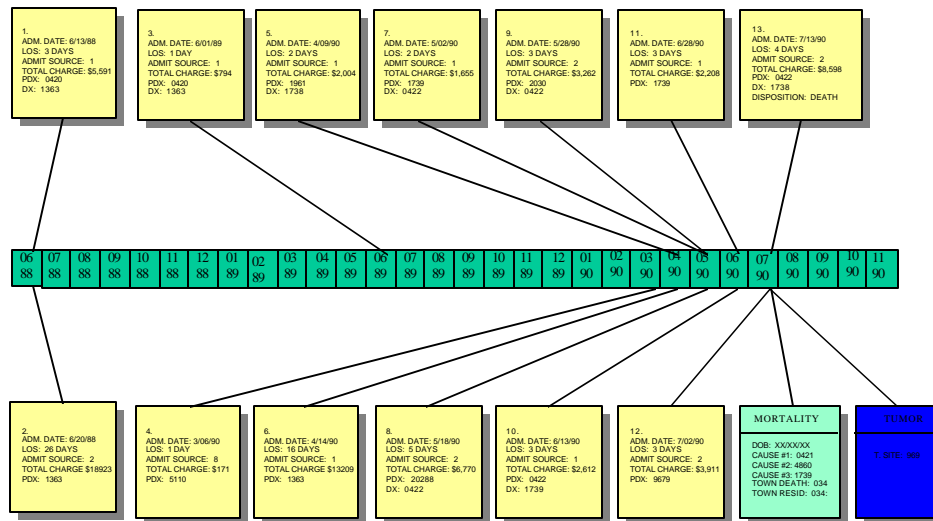
- Inconsistent Profile Data
 - Privacy concerns
 - Local formatting
 - Errors and work-arounds
- Complexity
- Calculation of link confidence
 - Lack of link “Gold Standard”
 - Indirect link paths

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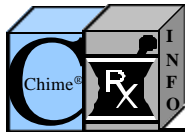


LINKING



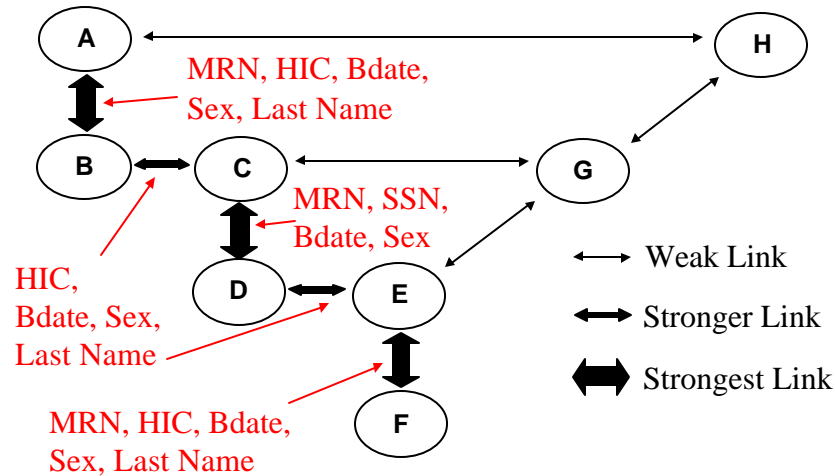
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Indirect Linking

Hospital 1 Hospital 2 Hospital 3 Hospital 4 Hospital 5



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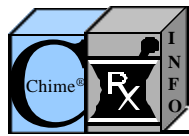


Technical Challenges

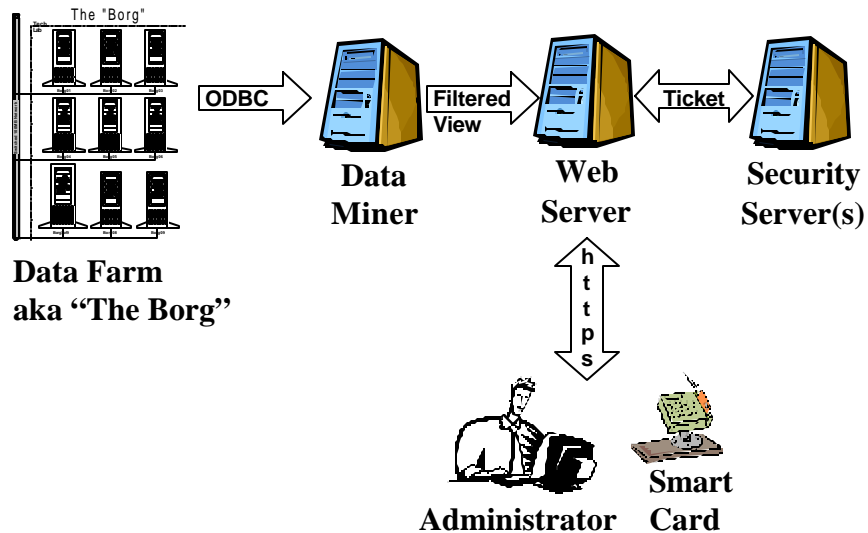
- Commercial Optimization Designed for Conventional Relational Database Technology
- How to Interface GUI with 'The BORG'
- How to Capture Ad Hoc Inquiry for Back-end Processing Optimization
- How to Integrate with Security Infrastructure/PKI for Authentication and Encryption
- Individual vs Statewide benchmarks
- Tools to assist in Budget and Forecasting processes for increasingly expensive products
 - Volume Purchases (last 1000 PT's w/ Dx)
 - Capability to query specific Dx, Drug, and LOS

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Ad-Hoc Reporting



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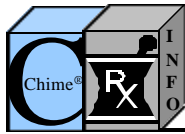


CHIME Solution: CHIME-Reports

- Physician Performance Analysis
- Market Area Payer Analysis
- Product Line Analysis
- Department and Physician Model
- Physicians Hospital/State Comparison
- DRG Market Share
- Inpatient Physician Activity by DRG
- Inpatient Physician Activity by Town
- Annual Case Mix Index
- APR-DRG Risk Mortality/Resource Intensity

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Technical Challenge: Asthma



- Affects 5-10% of the population
- Most common discharge diagnosis for hospitalized children
- Mortality rate is rising
- Responsible for 25% of school absences
- Costs exceeded \$5.8 billion in 1988

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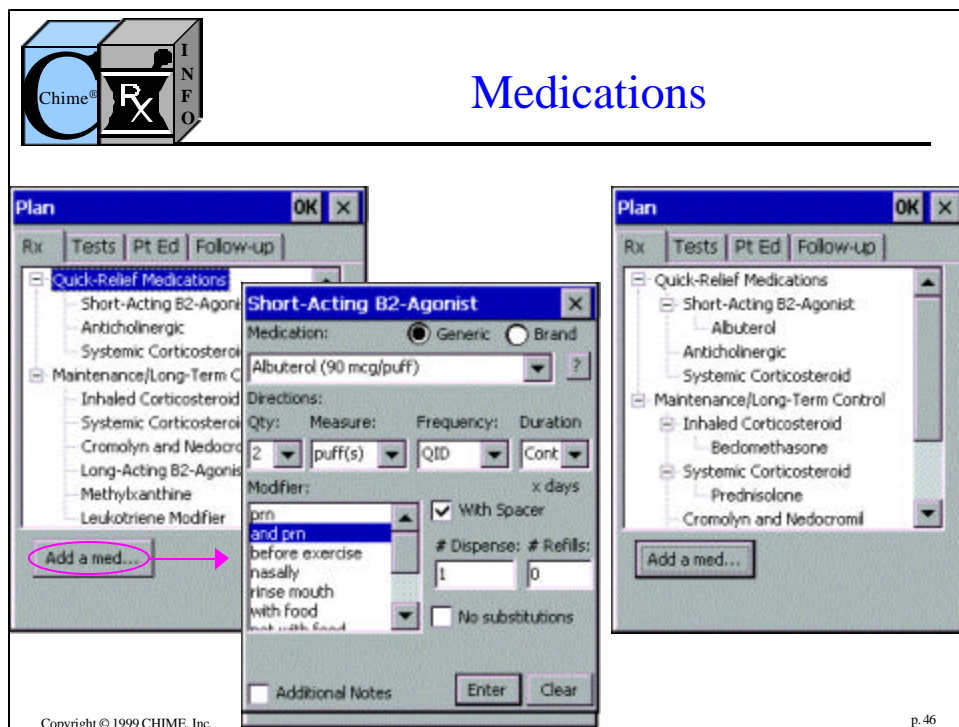
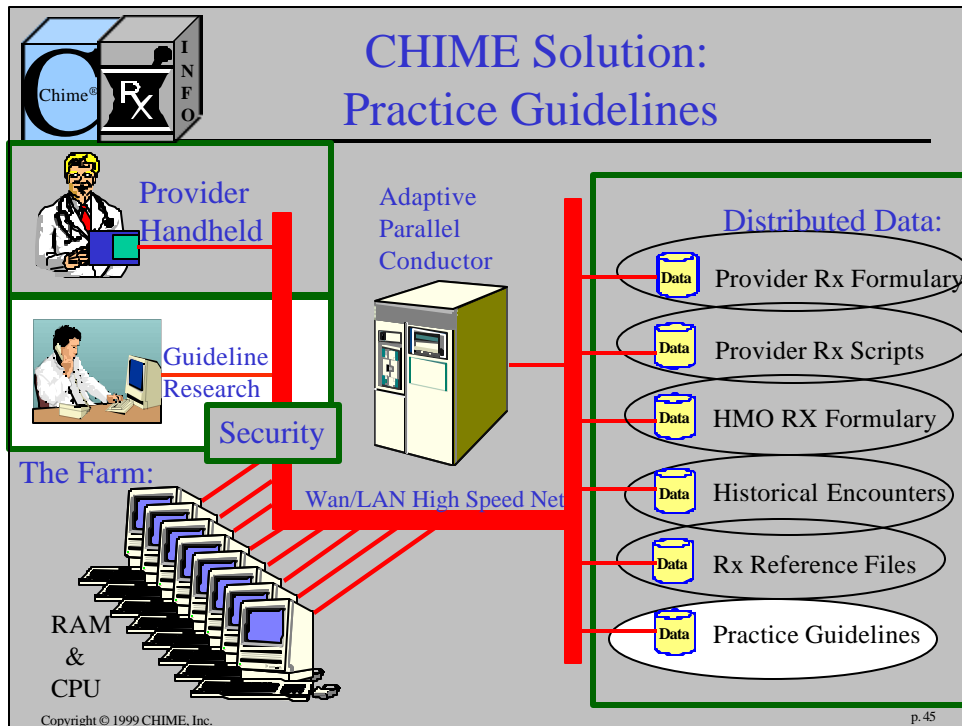
Technical Challenge: Guideline Complexity

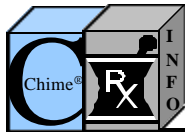
- Choice of appropriate medications depends on
 - Asthma classification (8 variables)
 - Level of control (11 variables)
 - Age
 - Exercise-related symptoms
 - Duration of current treatment
 - Clinician's strategy preference
- Decrease inappropriate practice variation
- Control spiraling costs
- Resource-intensive, expensive development process
- Little *Evidence-based* foundation
- Keeping Guidelines current with New Medications



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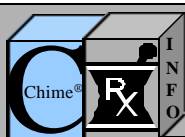


Technical Challenges

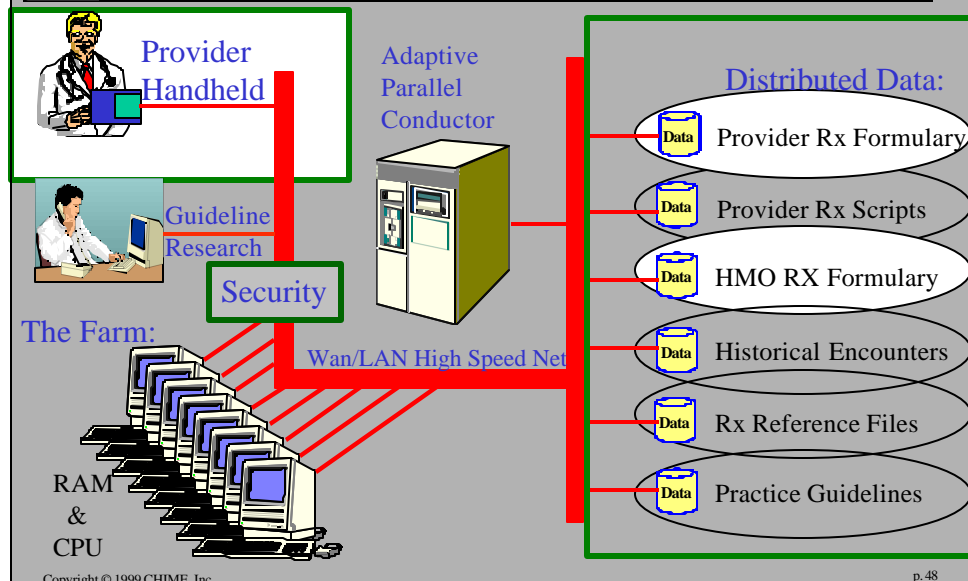
- HMO Formulary proprietary in nature
- Interface to HMO: Numerous and Challenging.
- Alternative to interface with HMO is to communicate through PBMC.
- Political Challenge, PBMC's have relations with Pharmaceutical Manufacturers.
- NDC Coding Insufficient for Eligibility Checking:
 - Identify product and manufacturer for eligibility
 - Too specific for clinician product selection.

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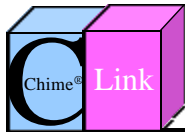


CHIME Solution: CHIME-Link EDI Applications



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CHIME-Link Applications

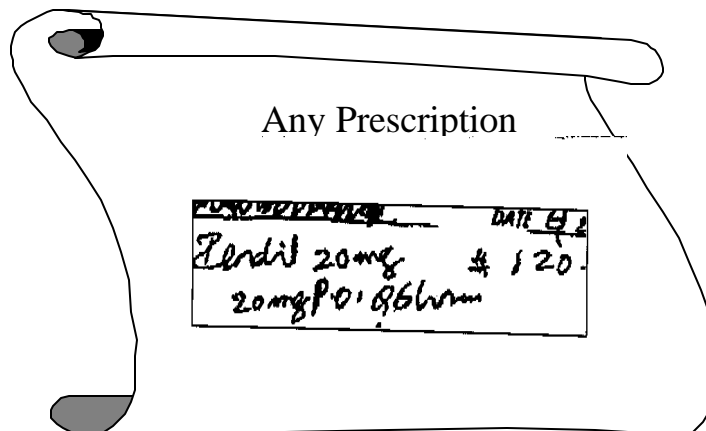
- Eligibility Verification
- Inter Agency Referral/Authorization (W10)
- Claims
- Unique Hospital Formulary Lookup
- Unique HMO Formulary (payer/Plan/Benefit Specific)
- Drug/ Prescription Eligibility Check, electronic routing
- PKI Directory Lookup
- Nursing Home Bed Availability
- Credentials/Sanctions Checking
- Interactive Reporting

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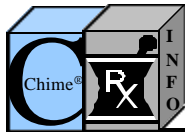


Technical Challenge: Medication Errors and Legibility



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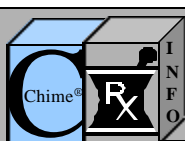


Global Impact of Medication Errors

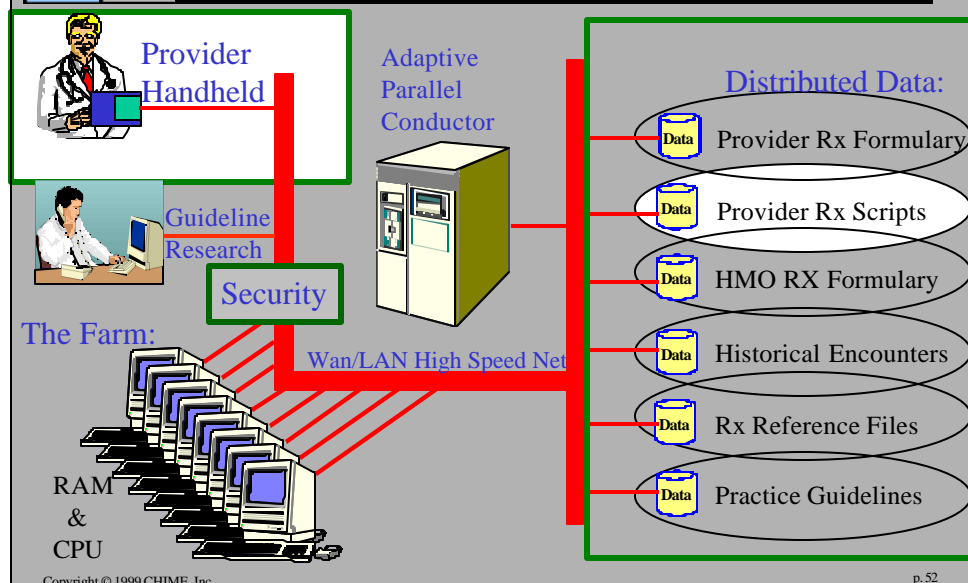
- As many as 1 out of every 25 patients Injured.
- Direct cost for inpatient ADE \$1900 to \$5900. JAMA 1998.
- 28%- 56% of all ADE's are preventable.
- Many events can be traced back to faulty prescription writing.
- Illegible, incomplete, or suspect medication orders.

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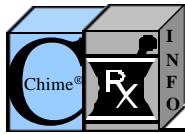


CHIME Solution: Prescription Writing Application



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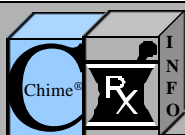


Technical Challenge: Handhelds

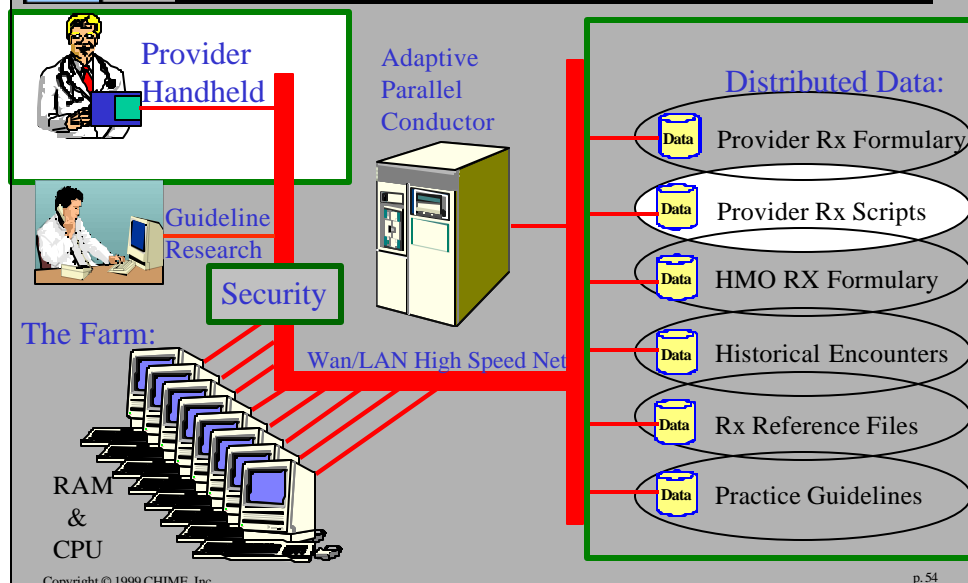
- Products in Evolution.
- Limited memory today.
- Limited power.
- Limited communications.
- Limited Security
- Accessing Compact Flash
- Demand Paging
- Communications Attachments
- Internalization (UNICODE)

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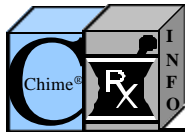


CHIME Solution: Handheld Applications



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RxInfo Solutions Commercialization Opportunities

- High Speed Network Connectivity
- RAM/CPU Farm Technology
- Handheld Query Interface
- Healthcare PKI Security Solutions
- Data Linking Technology
- Time-Zero Handler
- Data Driven Practice Guidelines
- Pharmacy-Outcome Data
- Pharmacology-Clinical Ontology
- Outcome Assignment
- Co-Morbidity Assignment
- EDI Transactions:
 - Eligibility
 - Formulary Checking
 - Prescription Writing

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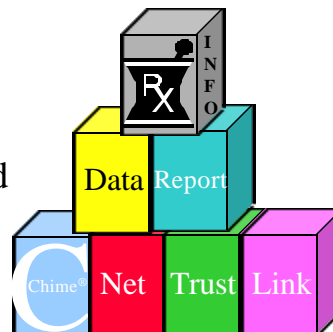
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Questions?

- For more information contact:

John Lynch
Vice President
CHIME, Inc.
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